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EROSION CONTROL PRACTICES DIVISION

Wheat Yields in Relation to Different Methods of Fallow - T. S. Aasheim, Havre, Montana.-"The following table gives the yields of winter wheat obtained in 1949 from the different methods of fallow in the tillage project at the Central Montana Branch Station.

Method of Fallow	No. of Tillage Operations	Bushels/acre Winter Wheat
Check (continucus use of oneway)	4	25.3
Subtillage	4	24.4
Subtillage (subtilled in fall)	5	24.0
Subtillage (with packer)	4	25.4
Chisel spring ≠ (subtillage)	5	26.7
Chisel fall ≠ (subtillage)	5	23.0
Oneway ≠ Subtillage	4	23.1

"No great differences in yield are apparent but the fall chiseled treatment is significantly lower than the treatment which was chiseled in the spring. Subtilling in the fall prior to the fallow season caused no significant yield difference."

New Terrace Design - B. H. Hendrickson, Watkinsville, Georgia.- "In a 15-acre Class III land station lespedeza field, the hay was cut, the stubble plowed under, old terraces smoothed down, and a series of new short nearly parallel terraces laid out to drain into 3 meadow outlets, instead of one. Tall fescue will be sown in October on the entire field. Fescue will remain indefinitely in the new meadow outlets."

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** All research work of the Soil Conservation Service is in cooperation with the various State Experiment Stations.

Wheat Yield in Relation to Tillage Methods - Harley A. Daniel, Guthrie, Oklahoma.-"Different methods of plowing for wheat production have been studied on the Wheatland Conservation Experiment Station at Cherokee the last eight years. The results are given in the following table.

Yield of Wheat From the Different Methods of Tillage on the Wheatland Conservation Experiment Station, Cherokee, Oklahoma

Method of Tillage	Grain - Bushels Per Acre	
	1949	Average 1942-49
Stubble mulch	12.5	14.5
Plowed	10.5	18.5
Listed	11.3	17.9
Basin Listed	10.3	17.6

"The highest average yield of wheat to date has been produced on the plowed land and the lowest on the mulched plots. However, in 1949 the mulched plots produced more wheat per acre than either the plowed, listed, or basin listed. This is the first time that these plots have produced higher yields than those tilled by the other methods. However, the rainfall during the wheat growing season of March, April, May and June was 17.28 inches. The average rainfall for this period is 11.95 inches."

Tillage Practices and Legumes for Sandy Farm Land - F. L. Duley, Lincoln, Nebraska.-"Tests on methods of subtilling sandy soils have been continued. Satisfactory methods have been worked out for using different types of tillers in the sandy farm lands around the border of the Nebraska sandhills. Fields have been prepared and seeded on these sandy soils with sufficient cover to give a high degree of protection against soil blowing.

"In order to make our stubble mulch system most successful on these sandy soils, however, it is deemed necessary to bring up the available nitrogen supply to a point where good crops can be produced, thus enabling us to have more residue for cover.

"Legume production would appear to be the most practical method of providing a nitrogen supply for other crops. Therefore, in cooperation with Dr. T. H. Goodding of the Department of Agronomy, work on finding a suitable legume for these conditions has been continued. Considerable progress has been made in the production of vetch and partridge peas on this land. Farmers are becoming interested in these crops and it looks like we may be able to use them in a stubble mulch system to good advantage. If we can do this the productivity of these sandy soils should be raised materially and at the same time good protection against wind erosion should be accomplished.

"A table showing the results obtained with the various legumes follows. Vetch and partridge peas can be grown successfully on many of these soils without special treatment. Sweetclover will probably require liming in many cases. This is not because the soils are highly acid, but because these sandy soils are too low in available calcium."

Results with Various Legumes on Sandy Soils In Nebraska

Location		Character of Legume Growth				
County	Test	Vetch	Partridge Pea	Lespedeza	Hubam	Biennial S. clover
Dundy	4	Fair	Fair	Poor	Fair	Good
Chase	1	Poor	Poor	-	Poor	- (a)
Box Butte	1	Fair	Fair	-	Fair	-
Custer	1	Excellent	Excellent	Poor	Fair	-
Pierce	1	Good	Good	Fair	Poor	Poor
	2	Good	Good	Fair	Poor	Failure
Antelope	1	Excellent	Excellent	Good	Poor	Failure
Knox	1	Fair	Good	Poor	Failure	-
Holt	1	Poor	Poor	Poor	Failure	-
	2	Good	Good	Good	Poor	-
Rock	1	Good	Fair	Poor	Failure	-
Brown	1	Excellent	Good	Fair	Fair	-
Madison	1	Good	Excellent	Fair	Fair	- (b)
	2	Excellent	-	-	-	-
Howard	1	Excellent	Good	Excellent	Poor	-

(a) Not included in test.
(b) Mr. Tiedgen grows sweetclover regularly on limed land.

Crop Yields from Three Classes of Texas Blackland in 1949 - J. R. Johnston. Temple, Texas.-"The 1949 crop yields from the rotation study on three classes of Blackland have been computed. The summarized data are shown in the following table. It is interested to notethat cotton, corn, and grain sorghums yields from Class II land are higher than for other classes. Oat yields were highest on Class I land. The lowest yields of all crops were from Class III land.

Land Class	Crop*			
	Cotton	Oats	Corn	Grain Sorghum
	Lbs. Lint/Acre	Bu./Acre	Bu./Acre	Bu./Acre
I	323	58.2	46.8	60.4
II	358	50.6	53.6	67.3
III	153	28.0	31.8	35.3

* Data for cotton acre averages of 17 plots.
Data for oats acre averages of 15 plots.
Data for corn acre averages of 14 plots.
Data for sorghum acre averages of 9 plots.

Soil Structure Studies - D. S. Hubbell, State College, N. M.-"Studies on soil structure have been continued. A briquette machine for testing soil hardness was constructed and test runs are now in progress. It appears from some preliminary data that hardness in a soil may be greatly increased when as little as 0.2% of total dispersion exists. In fact, soils with water stable aggregation in its highest state of development seem to have a friability index proportional to the amount of 2u clay that is in suspension. A complete set of laboratory samples is now in the making in order to test the preliminary findings shown in the following table:

Differences in Total Dispersion Between Hard Samples and Friable Samples With the Same Total Water Stable Aggregation

Sample Treatment	Hardness Index	Total Dispersion	Theoretical Dispersion
1 Normal soil	19	0.80	-
2 0.25% Flocculated 2μ Clay	10	0.68	-
3 0.50% " 2μ Clay	8	0.68	-
4 1.00% " 2μ Clay	6	0.72	-
5 Normal soil	20	0.76	-
6 0.25% Dispersed 2μ Clay	43	0.96	1.01
7 0.50% " 2μ Clay	86	1.16	1.26
8 1.00% " 2μ Clay	106	1.24	1.78

"If we are correct in our hypothesis that water-stable aggregation is only a measure of permanent structure and that total dispersion above maximum aggregation is the measure of friability, then our work on soil structure insofar as the current project is concerned will be completed."

Effects of Winter Protection in Maryland, 1948-49 - C. S. Slater, Beltsville, Maryland.-"Last fall Henry Hopp established winter protection plots at 10 widely separated locations in Maryland, from Oakland to Salisbury, and representative of markedly different conditions of soil, cropping and climate. This spring Henry and I sampled these plots and obtained the following data. Averages only are given.

Treatment	Earthworms Per sq.ft. No.	Earthworms Per sq.ft. Wt. gms	Volume of Large Pores %	Infiltration In. per min.	Water-Stable Aggregation %
None	20.7	3.10	5.9	.07	65.6
Alfalfa hay mulch	58.3	11.19	9.0	.17	68.7
Alfalfa hay mulch, fertilized	74.2	14.07	8.5	.22	71.4
Straw mulch	39.9	6.80	7.9	.12	68.8
Straw mulch, fert.	35.2	6.61	7.4	.10	65.5

"The averages present the picture that characterized most of the locations. On all the soils mulching increased the earthworm population. Earthworm weights and numbers appear to be related directly to volumes of large pores and infiltration rates. On sandy soils the volume of large pores and infiltration rates were affected least by mulching and showed no appreciable differences. Mulching with alfalfa caused a slight increase in aggregation, but the total results on aggregation are somewhat disappointing. Under the mild conditions that prevailed during the winter of 1948-49, it appears that the effects of winter protection on aggregation were not marked. This feature is common to all similar comparisons we have made this year, in contrast to the effects of protection during prior winters when mulching promoted or maintained a relatively high state of water-stability.

Effect of Earthworms on the Growth of Locust Seedlings - Slater.-"This is the report of a demonstration, not a replicated experiment. Locust seeds were planted June 15 in percolator cones in compacted Christiana silt loam to which fertilizer and organic matter had been added. One month before the planting twelve earthworms were placed in one of the containers. This gave the earthworms time to work the soil. Conditions for the soil in the two containers were identical otherwise. The following data tell the story.

Volume weight of compacted soil		1.7 Gms/cu. cm.
Rate of fertilization, 5-10-5		1000 lbs/acre
Organic matter addition		3000 lbs./acre
Height of locust Aug. 26,	with worms	49 cm.
	without worms	42 cm.
Weight of locust Aug. 26,	with worms	18 gms.
	without worms	13 gms.

Economic Values of Certain Land Resting Treatments - O. R. Neal, New Brunswick, N. J.-"The conservation value of growing cultivated crops in rotation with grass-legume crops has been shown by data from Marlboro and numerous other locations. In the vegetable areas of this state it usually is not desirable, from the operator's standpoint, to grow small grain between the cultivated crop and the grass-legume crop as is commonly done in livestock and general farming areas. This has given rise to the land resting practice of seeding grass-legume mixtures or other non-cultivated organic-matter-producing crops immediately following a cultivated crop. This practice reduces soil and water losses, adds organic matter and improves physical conditions of the soil, and ordinarily increases the yield of cultivated crops that follow the year of treatment.

"Four different land resting treatments were carried out on duplicate plots during the 1946 year. A clover-timothy mixture and a ryegrass-vetch mixture were seeded in the fall of 1945 and left throughout 1946. In addition, areas were seeded to oats cover in the fall of 1945, disced and seeded to soybeans on some areas and broadcast field corn on other areas in 1946. Each crop was disced down in late summer and rye winter cover seeded. Sweet corn has been grown on all these rested areas during the past 3 growing seasons. Yields from these areas and from adjoining continuously cultivated areas are shown in the table on the following page.

"In addition to the known conservation benefits of the land resting treatments, the data in the table show marked increases in crop yield as a result of the treatments. In 3 of the 4 cases total sweet corn production in 3 crops following treatment was greater than that from 4 crops on continuously cultivated land. The efficiency of production was greater on the rested areas since, in effect, only three-fourths as much land was under cultivation.

Influence of Conservation Treatments on Sweet corn Yield

Treatment	1949 Yield	Total Yield for Period 1946-1949
	No. 1 ears/acre	No. 1 ears/acre
Rested in clover-timothy during 1946	8580	27860 (3-crops)
Rested in ryegrass-vetch in 1946	8380	27840 (3-crops)
Rested in oats-soybeans-rye in 1946	7850	31140 (3-crops)
Rested in oats-broadcast corn - rye in 1946	8140	24120 (3-crops)
Continuously cultivated with winter cover of rye	6430	24920 (4-crops)

Nitrogen in Virgin and Cane Soil - R. M. Smith, Rio Piedras, Puerto Rico.-"Mr. Cernuda has completed pH and total nitrogen determinations for some soil samples collected at Aguirre to compare the condition of can land with adjacent soil in a more or less virgin condition:

Depth of Soil Sample	I Cane Soil		Virgin Soil Paired with I		II Cane Soil		Virgin Soil Paired with II	
	pH	%N	pH	%N	pH	%N	pH	%N
0-3	7.7	0.15	7.8	0.22	7.75	0.14	7.6	0.17
3 - 6	7.5	0.14	7.4	0.22	7.7	0.15	7.6	0.15
6 - 9	7.4	0.15	7.3	0.19	7.8	0.14	7.7	0.08
9 - 12	7.2	0.12	7.1	0.14	7.7	0.14	7.9	0.05
12 - 15	7.2	0.11	7.2	0.12	7.7	0.07	7.8	0.05

Depth of Soil Sample	III Cane - Soil		Virgin Soil paired with III-(Woodland)	
	pH	%N	pH	%N
0 - 3	7.5	0.17	7.5	0.36
3 - 6	7.6	0.18	7.5	0.31
6 - 9	7.5	0.19	7.5	0.21
9 - 12	7.6	0.17	7.5	0.16
12 - 15	7.6	0.15	7.6	0.12

"The results show little difference in pH but suggest a decline of total N in the upper part of the profiles. More paired samples are needed, although suitable locations are difficult to find. Deep tillage in the cane fields has apparently created a more uniform nitrogen content to 15 inches than where the soil has been less disturbed. Paired samples number II show some obvious textural discrepancy so we consider that the results for I and III are more typical.

Protein Content of Different Parts of Kudzu Plants - "As a check on the normality of growth of kudzu plants in a stand near Rio Piedras, Mr. Cernuda analyzed different parts of the plants for protein with the following results.

	% Protein Dry Basis
Leaves only	22.6
Buds only	15.2
Stems only	7.6
Roots only (no modules)	9.4

Method of Seedbed Preparation in Relation to Yield of Corn and Oats - O. E. Hays, LaCrosse, Wisconsin.-"A seed bed preparation study for corn and grain was initiated last fall (1948) in which the plow and the Graham-Hoeme cultivator are compared. The Graham-Hoeme is equipped with knives. Our procedure has been to set the Graham-Hoeme shallow for first double tillage so that the knives are riding on the surface part of the time. Where possible, the first operation is at an angle to the contour, the second operation on the contour. The land is then left lay until loosened vegetation is dried out and apparently dead. Then repeat tillage with machine set so that knives are cutting about 2 or 3 inches below the surface. The plow was set to turn the soil about 5 inches deep. These operations were completed by the end of October. Both areas were left in a rough condition over winter.

Crop 1948	Treatment	Crop 1949	Yield, Bu./acre
Alfalfa-brome-quack hay	Fall plowed	Oats	68
Alfalfa-brome-quack hay	Graham-Hoeme	Oats	60
Corn	Fall plowed	Oats	86
Corn	Graham-Hoeme	Oats	100
Alfalfa-brome-quack hay	Fall plowed	Corn	80
Alfalfa-brome-quack hay	Graham-Hoeme	Corn	77

"Certainly we are not recommending the use of the Graham-Hoeme in place of the plow for corn on the basis of only one year's data. The results, however, are more encouraging than any we have had with field cultivator or disc for corn. It does leave a nice mulch on the surface when used in pasture renovation or on old hay land. The land can be easily tilled to 8 to 10 inches deep. We plan to continue these experiments for five years to get a fair sample of the weather."

Soil Splash Measurements - G. R. Free, Marcellus, N. Y.-"There are many practical and familiar examples of soil splash by raindrops, ranging from sand in our spinach to erosion on cropland but quantitative data on just how much soil can be moved in this way are not too plentiful. Small pans of soil, about 12" above ground level, were exposed to natural rainfall from May 15 to August 8 at Marcellus. The soil was kept at a high moisture level so that soil was not removed by wind. Free drainage was provided so that water could percolate through or be lost by splash and runoff. The runoff was caught and the soil in it determined. The total loss in weight of dry soil in these pans over the preiod represented splash and erosion loss. One set of these plots was bare and another covered with a light straw mulch.

Treatment	Total Precipitation	Percolate	Soil Loss	
			Splash	Erosion
	Inches	Inches	Tons/acre	Tons/Acre
Baro	7.64	1.76	31.3	0.8
Mulch	7.64	2.82	4.6	0.3

"These data show that the mulch reduced the soil carried in runoff and maintained the infiltration capacity at a much higher level. Its greatest effect, however, was in reducing soil loss by splash.

"The conditions of this experiment were, of course, artificial. Normally, the moisture content of soil is very much of a variable, and also normally the splash would return to the soil - at least temporarily. Even so, under field conditions, it marks the beginning of a chain of events which could lead to serious erosion, soil crusting and still further reductions of infiltration capacity."

Tomato Irrigation Results, Wayne County - E. A. Carleton, Geneva, New York.-"The tomato irrigation experiment at Wolcott, N. Y. has yielded some very interesting data. Two varieties were under measurement for response to supplemental irrigation. There was less loss from blossom and rot with irrigation for both varieties. The second table shows that irrigation had an effect on date of ripening also.

Treatment	Percentage of Fruits with Blossom End Rot	
	Stokesdale	Red Jacket
	%	%
Not Irrigated	54.8	34.9
Irrigated	37.1	16.3

Response of the Ripening of Tomatoes to Supplemental Irrigation

Picking Date	Average number of ripe fruit per plant Red Jacket Not Irrigated	Red Jacket Irrigated	Stokesdale Not Irrigated	Stokesdale Irrigated
August 16	4.3	1.1		
August 25			8.8	3.2
August 31	10.9	8.4		
September 8	12.4	11.8	12.9	10.9
September 16	10.9	13.6	7.7	10.5
September 28	6.1	10.0		
September 29			5.2	12.5
TOTAL	44.6	44.9	34.6	37.1

Potato Irrigation Results, Tioga County - John Lamb, Jr., Ithaca, New York.-"This summer, in cooperation with Professor Arthur J. Pratt, we helped irrigate and apply mulch on seven 4-H potato experiments in as many different counties. The plots in Tioga County were dug one day and the following yields were reported by Professor Pratt the next day. That seems a record for promptness. There are 8 replications of 8 varieties in each of the following averages:

Treatment	Yield in Bushels Per Acre	
All irrigated plots	500	
All non-irrigated plots	351	
Increase due to irrigation		149
All 1st plantings (May 26)	499	
All 2nd plantings (June 16)	352	
Increase due to early planting		147
All mulched plots	462	
All non-mulched plots	388	
Increase due to mulching (2 ton straw/A.)		74
Early planted and irrigated	581	
Early planted but not irrigated	416	
Increase		163
Late planted and irrigated	416	
Late planted but not irrigated	286	
Increase		130
Irrigated, planted early, mulched	611	
Not irrigated, planted late, not mulched	245	
Increase		366

"The total rainfall at the plots for June, July, August and September was 10.95", and 4.75 inches of water was added in five irrigations."

Treatments Used in Reclaiming Abandoned Eroded Land - Harley A. Daniel, Guthrie, Oklahoma.-"Yellow Bluestem grass (Andropogon ischaenaem) was seeded on about 12 acres of formerly abandoned eroded land on this station in the spring of 1949. About 1.3 acres of this area was badly gullied land and was plowed and leveled in the winter of 1946. This portion was treated with 200 pounds of superphosphate per acre and seeded to sweet clover in the spring of 1947. The sweet clover produced 234 pounds of seed per acre in 1948. In the spring of 1949, the entire 12 acres was plowed and 300 pounds of superphosphate and 100 pounds of ammonium nitrate per acre was applied on all of it except a few check plots. Before the grass (Yellow Bluestem) was seeded, a nurse crop of oats was planted in 16-inch rows to protect the soil from erosion while the grass was becoming established. Yields from the nurse crop of oats is given in the table following.

"During May and June, 1949, there was 21.64 inches of high intensity rainfall. Although these were severe storms, the above cover of oats protected the once abandoned, eroded area from severe erosion.

Yield of Oats Used for Nurse Crop of Yellow Bluestem Grass on Fertilized, Shallow, Eroded, Abandoned Land, Guthrie, Oklahoma in 1949

Treatment 1/	Yield - Per Acre	
	Grain - Bushels	Straw - Pounds
Fertilized	40.5	1852
Fertilized gully area, & 2 years sweetclover 2/	44.0	2248
Check	4.0	151

1/ Superphosphate, 300 lbs. per acre, and ammonium nitrate, 100 lbs. per acre, applied in spring 1949.

2/ Gullies in this area were plowed, bulldozed and leveled. Then in the spring of 1947 they were seeded to sweet clover and 200 lbs. per acre of superphosphate added.

Cover Crop Studies - C. J. Whitfield, Amarillo, Texas.-"Legumes as cover crops have been on trial at the station for the past two years. Plantings of three types, Austrian winter peas, hairy vetch, and Madrid clover were made the middle of September to continue these trials. All plantings emerged to an excellent stand in a very short time. Additional plantings will be made the middle of October to determine which is the better planting date.

"All wheat plots and fields were seeded during the last half of September with the exception of one field which was seeded on September 6 for early grazing. Sufficient soil moisture was available in most cases to bring the wheat up in a period of about seven days. There was considerable heavy wheat-straw residue still remaining on the plots that were plowed with the sweep machine. It was necessary to plow just ahead of the drills to kill volunteer wheat. This left a rather loose condition on the surface which made it impossible to use a disc drill where there was heavy residue. The residue and soil would shove in front of the discs and completely clog the drill. The shovel-type drill, with 14-inch spacings, worked very well in all of the heavy residue plots and fields on the station. This past season, with the exceptionally heavy straw residue left on the surface, presented an excellent opportunity to test both tillage and seeding implements

for use in stubble mulch farming. Any machine that will work in the conditions we have this season will be a satisfactory machine for stubble mulch farming in most of the Great Plains area.

Stubble Mulch Studies - "Organic matter content and volume weight determinations were made on some soils from one replication of the stubble mulch plots to gain information concerning any differences attributable to differing tillage practices during the past eight years.

"Samples taken from the top six inches of soil at the time the plots were established were found to contain 2.44 percent organic matter. At present, the highest organic matter content is in the 3- to 6-inch layer in the subtilled continuous wheat plot, amounting to 2.23 percent. The lowest organic matter content is in the 0- to 3-inch layer of the oneway fallow plot, amounting to 1.78 percent. In general, in all cultivated plots, organic matter content is higher under continuous wheat than under a fallow system and is higher under subtillage than where the oneway or moldboard plow was used. As a matter of interest, the O.M. content of a nearby pasture of virgin prairie, having a composition of 65 percent blue grama and 35 percent buffalograss, is given.

"Volume weights were found to be about the same where the oneway and subtillage machines were used. The volume weight of the soil on the moldboard plow continuous wheat plot was appreciably higher from the 3- to 9-inch depths. Soil under a fallow system had higher volume weights at all depths, indicating that structure is not being maintained as well under a fallow system as under continuous wheat, the difference possibly being related to the lower organic matter content. The increase of volume weight with depth observed in the top foot, frequently reaching a value of 1.8 of higher in the 9- to 12-inch layer, has been cited as evidence of a deterioration in structure due to cultivation. In this connection, the volume weights of soil from the virgin prairie are interesting in that volume weights as high as those existing under cultivation at comparable depths were observed, indicated that continuous production of wheat with its fibrous root system does not cause an increase in volume weight.

Table 1.--Organic matter content of soil from stubble mulch plots and from virgin buffalo-blue grama prairie.

Tillage	Percentage Organic Matter	
	0-3"	3-6"
	Continuous Wheat	
Oneway	2.07	2.10
Subtilled	2.11	2.23
Moldboard	1.95	2.05
	Wheat-Fallow-Wheat	
Oneway	1.78	1.82
Subtilled	1.97	2.03
	Virgin Prairie	
	3.01	2.27

Table 2.--Volume Weight of Soil from Stubble Mulch Plots and from Virgin Buffalo-Blue Grama Prairie.

Tillage	Volume Weight 0-3"	3-6"	6-9"	9-12"
		Continuous Wheat		
Oneway	1.36	1.41	1.63	1.76
Subtilled	1.38	1.43	1.66	1.76
Moldboard	1.41	1.52	1.73	1.78
		Wheat-Fallow-Wheat		
Oneway	1.37	1.50	1.71	1.81
Subtilled	1.42	1.56	1.74	1.83
		Virgin Prairie		
	1.40	1.51	1.74	1.80

Pasture Irrigation Yields - John Lamb, Jr., Ithaca, New York.-"The partial pasture yields for 1949 are shown in the following table. The summer was dry and hot. There were indications that not enough water was added, and in some cases, added in too small increments. The early application of water, although the soil was not noticeably dry, stimulated the growth of the Ladino clover more than the grasses. Again, in midsummer, we believe low temperature grasses cut yields. Both seasons high nitrogen reduced the percentage of clover, probably due to shading. Early grazing could have prevented this. In a vineyard cover experiment at Hammondsport, we held Ladino clover under high nitrogen fertilization for eight years. The spring growth at the Arnot was large enough for a high quality hay crop. We have used the water in 1949 to carry the fertilizers down into the soil. The plants at the end of a grazing period are in a shocked condition due to removal of so much leaf surface. It takes some time for the plants to grow enough leaves to resume active photo-synthesis. The water and fertilizer seem to break the rest period and speed up growth.

The effect of water added and various fertilizer practices on pasture yield. Arnot Station 1949[1]

Soil Treatment and Date	Period Dates	Rain in.	Irrigation Inches	Sample Date	Rain T/A	Rain & Irrig. T/A	Increase T/A
Base only	4/25-6/1	4.0	2.5	June 1	.31	.65	.34
	6/1-7/13	1.7	3.7	July 13	.11	.43	.32
	7/13-8/25	3.6	2.6	Aug. 25	.08	.20	.12
				TOTAL	.50	1.28	.73
10-10-10, 500 lbs. Apr. 25	Same			Same	1.06	1.19	.13
	as			as	.07	.53	.46
	Above			Above	.02	.36	.34
				TOTAL	1.15	2.08	.93
10-10-10, 500 lbs. April 25	Same			Same	.95	1.33	.38
10-10-10, 250 lbs. June 13	as			as	.11	.54	.43
10-10-10, 250 lbs. July 25	Above			Above	.36	.43	.07
				Total	1.42	2.30	.88

(Table continued on page 13).

10-10-10, 500 lbs. April 25	Same	Same	.98	1.00	.02
20-0-0, 125 Lbs., June 13	as	as	.10	.60	.50
20-0-0, 125 lbs. July 25	Above	Above	.26	.49	.23
		Total	1.34	2.09	.75
10-10-10, 1000 lbs. April 25	Same	Same	1.64	1.58	.06
10-10-10, 335 lbs. June 13	as	as	.06	.62	.56
10-10-10, 335 lbs. July 25	Above	above	.41	.59	.18
		Total	2.11	2.79	.68
0-20-20, 500 lbs. April 25	Same	Same	.46	.70	.24
0-20-20, 250 lbs. June 13	as	as	.12	.46	.34
	Above	Above	.15	.24	.09
		Total	.73	1.40	.67

1/ Potential water needs June 1 through August 25 estimate inches 14.3. Rain 5.3 plus irrigation 6.3 = 11.6. April and May rainfall 6.1 inches.

Root Counts on Native Range and Seeded Pastures - O. K. Barnes, Laramie, Wyoming.-"Root counts were made this year on the rate of use pastures and on some of the seeded pastures. A preliminary summary of these counts is made in the following table. The method used for this study was to dig a trench approximately 2 feet deep by 4 feet long. A frame 3 ft. x 1-1/2 ft., divided into squares 6 x 6 inches was used. Counts were made of all roots showing on the face of the cut and recorded for each of the 18 squares. Three trenches were dug on the major vegetative type on each rate of use pasture. As a matter of comparison, similar root counts were made on some seeded dryland pastures within an exclosure protected from grazing.

"As shown in the table, the root count in the 0-6 inch level is somewhat lower on the heavy rate of use pasture. At the other levels the variations appear unrelated to the rate of use. The seeded pastures show a considerable higher count at the 6-12 inch zone than do the native pastures. The seeded western wheat pasture more nearly resembles the native range than does the created wheat and Russian wildrye.

Root Counts on Native Range Under 3 Different Rates of Grazing Since 1944 With Comparisons on Seeded Dryland Pastures

	Counts Per 36 square inches		
Native Range	0-6 inch	6-12 inch	12-18 inch
Light use	126.	30.	8.
Moderate use	112.	25.	17.
Heavy use	100.	24.	9.
Seeded Pastures within Exclosure			
Light use	119.	69.	25.
Russian wildrye	115.	72.	37.
Western wheat	86.	34.	10.

Pasture Improvement in Relation to Runoff and Beef Gain - D. D. Smith, Columbia, Missouri.-"The effect of pasture improvement on rate of runoff with a wet soil condition was shown by the rain of September 12. This rain was not as high intensity as the one of August 19, but produced much higher runoff rates. Maximum rate of runoff from the young Ladino clover bromegrass pasture on the deep limed and shattered subsoil area was only one-half that of the check area. Rainfall and rate of runoff data for the two rains are as follows:

	8-19-49	9-12-49
Previous rainfall, inches (34-hr. period)	.16	2.75
5-minute intensity (inches per hour)	5.92	4.80
15-minute intensity	5.44	3.36
30-minute intensity	5.24	2.04
60-minute intensity	3.18	1.08
Total amount (inches)	3.80	1.08
Maximum runoff rate, 2-acre pasture, in inches per hour:		
Check bluegrass pasture	.38	1.20
Disked and fertilized bluegrass	.31	.82
Young ladino clover and bromegrass on deep limed and shattered subsoil	.07	.62

"Mr. Whitt reports: 'The grazing season ended in September for all permanent pastures under study. Until November 15 they will be allowed to store nutrients for next spring. Any growth remaining will be utilized as winter picking. The season ended also for Korean lespedeza. Ladino clover and bromegrass will be grazed until October 7. Summary of results for the year is as follows:

	Beef Gain (Lbs.) per acre	Beef Gain (Lbs.) animal day
Birdsfoot trefoil and alta fescue (1)	124	1.13
Lespedeza (following wheat for grain)	306	2.17
Wheat	124	2.82
Lespedeza (following wheat grazed)	205	2.18
Rye	66	2.56
Bluegrass and lespedeza	248	1.38
Bromegrass and sweet clover	170	1.47
Improved bluegrass (2)	220	1.58
Bluegrass (no treatment)	164	2.12
Bluegrass and birdsfoot trefoil	145	1.28
Alta fescue	162	1.31

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(1) Seeded April 1949; grazing started June 20.
(2) Phosphate and potash level adequate. 100 lbs./a. ammonium nitrate in spring and another 100 lbs./a. in the fall."

DRAINAGE AND WATER CONTROL DIVISION

Hydrologic Studies - L. L. Harrold, North Appalachian Experimental Watershed, Coshocton, Ohio.-"Some thought and field work has been accomplished towards the establishment of a simple system of surface-water interception. Two fields were selected - one on 12 percent slope and the other on 6 percent. These fields were plowed in narrow lands so that the resulting dead furrows would be about 30 - 40 feet apart and their slope not more than 1 percent. None of these furrows are more than 400 feet long. All drain into sod waterways. The plowed land was fitted for seeding by disking and harrowing. Finally, a single disk was pulled through the dead furrows to throw out a little more soil.

"The land is now seeded to wheat - in one field along the line of the furrows - and the other in straight rows crossing the furrows at 45° angle. As soon as the loose ground is settled by rainfall, levels will be run to determine cross sections and profiles of these interception ditches - or furrows. Their performance will be observed over the winter and spring seasons. From these observations, plans will be developed for similar systems to be tried out in cornland next April.

"Mr. Dreibelbis reports that 72 soil cores for permeability studies were obtained on watersheds 103, 110, 115, and 123 representing the Keene silt loam and on watershed 109 representing the Muskingum silt loam. Sixty-eight additional cores were received from Columbus, Wooster, and Zanesville and laboratory data obtained on transmission and percolation rates and other soil characteristics, such as volume weight, total pore space and soil-moisture content at 60 cms. tension. This study was part of a project sponsored by Research-Operations to obtain data on soil characteristics from the soil from various parts of the country."

Hydrologic Studies - R. W. Baird, Blacklands Experimental Watershed, Waco, Texas.-"A comparison between the terraced and contour cultivated Y-10 watershed and the conventional farmed up and down the slope W-10 watershed shows very little difference in moisture conditions at the end of the season. The moisture conserved on the Y area has been utilized in an increase in crop growth during the growing season. The percentages of moisture from the Y-10 area were as follows: Cotton land, 24.2 percent; Cornland, 22.7 percent; and Oat stubble, 21.8 percent. The same crops in the W-10 area were: Cottonland, 24.4 percent, Cornland, 20.9 percent; and Oat sttuble, 21.1 percent. The average from all samples from corn, cotton, and oat-stubble areas from the Y-10 watershed was 22.9 percent in comparison to 22.1 percent from the W-10 watershed. These percentages indicate only minor differences in moisture conditions at the close of the cropping season. A comparison of crop yields from the two areas will be made as soon as the harvest is completed.

"K. R. Bluestem (andropogon ischaemum) seeded March 4, 1949, has made an excellent showing in competition with Johnson grass. It looks as if it will hold its own and possibly suppress the Johnson grass with another season's growth. A seed crop is in the making which should be ready to harvest by the middle of October.

"Ky. 31 Fescue seeded in November of 1948 made a fair growth and furnished some grazing. It lived through the summer and has started greening up with the recent showery weather."

Hydrologic Studies - John A. Allis, Central Great Plains Experimental Watershed, Hastings, Nebraska.- "In September particular emphasis was placed in treating watershed W-5 containing 411 acres, with conservation practices. The Regional, State, District and Work-Unit offices cooperated in this undertaking and it is felt that considerable progress has been made. Eleven grass waterways were prepared and seeded during the first half of the month. Various kinds of grasses were planted, including Brome, Western Wheat, Crested Wheat, Switch, and Intermediate Wheat grass in accordance to a table which had been prepared by Operations and Research personnel. In most cases these grasses were mixed using two or more grasses, and on one waterway all varieties of grass were planted. We also have single waterways of Brome, Western, and Intermediate. Alfalfa and Sweet-Clover were included in most waterways to provide nitrogen. Grasses were planted at the rate of approximately 40 pounds of seed per acre.

"In addition to the work on the grass waterways, approximately 12,000 feet of broad-base terraces were constructed. The State office furnished a caterpillar tractor, Research furnished the terracer and a tractor operator, and the farmer on whose land the work was done operated the terracer and furnished the gasoline for the tractor. The Work-Unit laid out the terraces."

Hydrologic Studies - G. A. Crabb, Jr, East Lansing, Michigan.-"Precipitation for the month of September, as measured by the USWB type of non-recording rain gage, amounted to 2.44 inches at the cultivated watersheds, 2.62 inches at the wooded watershed, and 2.39 inches at the stubble-mulch plots. "These amounts are approximately 84 percent, 90 percent, and 82 percent of the 5-year average September precipitation of 2.91 inches. September precipitation can be expected to equal or exceed 2.44 inches once in 1.7 years. Cumulative rainfall for the year is approximately 110 percent of normal. There were no runoffs from the watershed during the month.

"Solar radiation for the month equaled a total of 7378.5 gram-calories per second per square centimeter at the pyrheliometric station located at the cultivated watersheds. This is approximately 79 percent of normal radiation to be expected here, and gives an annual cumulative amount of radiation received of 82971.1 gram-calories, or 92 percent of normal.

"During the month several conferences were held with members of the project advisory committee to tentatively plan conversion of the watershed cultural practices from regular tillage to mulch culture. Drs. Turk and Millar were especially helpful in this planning. September 26 was spent in the field with Dr. Millar in an evaluation of mulching practices in use on cooperator L. H. Wark's orchards near South Haven, Mich. This trip conclusively proved to us that the 'culti-cutter' as used by Mr. Wark to stunt the growth of his orchard cover, though ideal for that purpose, is not suitable for seed-bed preparation as would be required in a watershed use of mulch-cultural practices. September 30 through October 2 were spent by the project supervisor and Dr. Millar in an on-the-spot study of mulch-cultural practices as used on the experimental watersheds at Coshocton, Ohio. Numerous objections were found in regard to the use of the subsurface tillage implements and disk harrow alone. However, considerable promise is seen in a utilization of a small 10-12-inch plow, half-inverting the furrow slice, followed by further drawing up on organic matter to the surface and the preparation of a seed-bed with a spring tooth harrow. Such a program, in conjunction with judicious use of herbicides, seems to offer considerable possibility for use on a watershed basis.

"However, there are a few questions aroused by the use of mulch practices on a watershed basis which it might be well to keep in mind:

(a) Will the ultimate effect of such practices be to develop a thin surface soil?

(b) The use of such practices increases the problem of weeds. Some solution to this problem must be worked out for successful use of these practices.

(c) Would such practices have an ultimate effect of compacting the subsurface (below tillage depth) soil to too great a degree?

(d) To date, field use of mulching practices has been accompanied by poor stands of corn. Why?

"If possible, answers to these questions should be obtained before deciding to convert the watersheds to such a tillage practice. If the answers are not presently obtainable, the problems should be incorporated in the study in the form of anticipated accomplishments of the study.

"The adaptation of mulching practices followed by the Wark Orchards gives rise to some questions similar to the above. In his work, Mr. Wark isputting a great deal of emphasis on extraordinarily large amounts of fertilizer in conjunction with irrigation and continual orchard cover. Instead of cutting this cover, it is broken and stunted (to prevent excess water use) by means of the 'culti-cutter,' and all residue returned to the soil with a consequent improvement in soil structure. To avoid compaction, all spraying is done from outside the orchard block, thus no wheels are put on the surface of the orchard proper. There seems little basis for this use of such large quantities of phosphorus and potassium. The question is raised as to whether the accumulation of dead vegetation on the soil surface will develop a fire hazard, provide shelter for rodents and insects, and/or give rise to too great root development at the soil surface. His excessive use of nitrogen may have a tendency to promote too great an annual growth, with consequent severe winter damage. On the other hand, his limited spraying program is apparently working out well, with a large production of fruit. And this, after all, is the ultimate test of an orchard. The project supervisor is withholding final comment until the opportunity is taken for more observation."

Hydrologic Studies - T. W. Edminster, Blacksburg, Va.-"Rainfall and runoff are at present being studied on the increment-mass basis rather than on the basis of the peak rates. Data were reworked to provide tables of maximum amounts occurring in 5 -, 10-, 15-, and 30-minute periods.

"Increments of rainfall per period are readily related to increments of runoff for similar periods on the Blacksburg watersheds when these watersheds were planted in rows running up and down the slope. At Chatham, the relationship of rainfall and runoff increments per period is greatly influenced by some other factor. Presumably the increased surface detention in the contoured rows and terraces is at least partially responsible.

"The further progress is made in these analyses, the more it becomes evident that basic information on the application of the laws of hydraulics is essential. Such phenomenon as the depth-discharge relationships of overland or channel flow are primary factors in the prognostication of surface runoff from assumed or known rainfall. Retention in the form of storage or infiltration also play a major role. Present effort is toward a rational application of these factors."

Farm Ponds - T. W. Edminster, Blacksburg, Va.- "On September 7, Mr. Holtan presented a paper 'Sealing Farm Ponds' at the North Atlantic Section Meeting of the American Society of Agricultural Engineers at State College, Pa."

Runoff Studies - N. E. Minshall, Madison, Wis.-"Precipitation at Edwardsville was 2.99 inches. Of this amount 2.35 inches occurred on the 12th, but the maximum amount for one whole hour was only 0.60 inch, and total runoff was 0.23 inch. Temperatures varied from the maximum of 90 degrees on the 4th, to a minimum of 35 degrees on the 24th.

"Precipitation at Fennimore was 1.08 inches, all of which occurred as scattered light showers during the first half of the month. There was no surface runoff. Temperatures varied from a maximum of 77 degrees on the 2d, to a minimum of 25 degrees on the 29th, with a mean of 56 degrees, or about 7 degrees below normal for the month.

"Precipitation at Colby was 1.93 inches and there was no surface runoff.

Hydraulic Studies - F. W. Blaisdell, St. Anthony Falls Hydraulic Laboratory, Minneapolis, Minnesota.-"In western Nebraska Mr. Blaisdell accompanied Mr. Quackenbush, Irrigation Engineer in Region V, in an inspection of irrigation structures, some of which had been previously tested at the St. Anthony Falls Hydraulic Laboratory. Here again the field results verified the laboratory findings except as regards scour at the outlet of drop structures. The scour in the field seems to be much less than that predicted from the model tests. This difference may be due to the lower erodibility of the field soil and the protection afforded by vegetation. Sand was used in the models. In future model tests it may be necessary to use model bed materials having a greater resistance to erosion than the sand now used in order that we may properly evaluate the scour to be expected under various field conditions. It was interesting when talking with Mr. J. Russell Batie, acting project supervisor at the Mirage Flats Case-Wheeler Project, to find that severe scour around the inlet to a pipe drop structure, which was unsuspected prior to the laboratory tests, was verified to the extent that the drop washed out when water was allowed to flow through it before the recommended entrance had been installed. Entrances based on the laboratory tests appear to be performing as satisfactorily as was anticipated from the model tests made here at the St. Anthony Falls Hydraulic Laboratory."

Hydraulic Studies - W. O. Ree, Outdoor Hydraulic Laboratory, Spartanburg, S. C.-"During September several tests were made on the waste chute at the hydraulic laboratory. This chute was built to drop the waste water from the experiments into Stillwater Creek. The total fall is 11 feet and the peak discharge to be handled is 175 c.f.s. The chute has a Wisconsin-type entrance and a St. Anthony Falls stilling basin. Its inside width is 6 feet 9-1/2 inches.

"The construction of this chute offered an opportunity to make controlled tests on a field-size structure. Ordinarily, the only experimental measurements available are those obtained from tests on models. Opportunities for measurements on the prototype are rare. Accordingly, when this chute was designed and built consideration was given to its use as an experimental structure. It was dimensioned exactly in accordance with the recommendations of the St. Anthony Falls Laboratory. When these tests were made Mr. Fred Blaisdell came down to observe.

"Three flows were run during these tests. These were 160, 90, and 22.5 cubic feet per second. It was planned to run 45 c.f.s. also, but this test was rained out. It was not possible to obtain the design discharge of 175 c.f.s. The level of the lake was too low. The maximum discharge obtainable was 160 c.f.s. The results of this peak test will be discussed briefly.

"In general the chute functioned very satisfactorily. The efflux from the stilling basin was fairly tranquil. There was very little scour below the basin oven though the flow duration was 6 hours. However, the bed material was a rather hard clay and excessive scour was not expected. There was some splash and spray from the stilling basin. The amount of this splash was neglible even though drops reached a height of 8 feet above the water surface at times.

"The flow profile in the chute differed from that predicted. The estimated profile was taken from figure 10 in the paper 'Report on Tests Made on Three Types of Flume Entrance,' by Mr. Blaisdell and Mr. Huff. The profiles are compared in the following table:

Distance from chute entrance	Predicted flow depth*—feet	Actual flow depth*—feet	Difference feet
	feet	feet	
0	3.60	3.33	-.27
2	3.54	3.27	-.27
5	3.23	2.73	-.50
7	3.05	2.30	-.75
10	2.55	1.95	-.60
12	2.27	1.72	-.55
15	1.85	1.50	-.35
20	1.40	1.25	-.15
25	1.30	1.00	-.30
27	1.30	.98	(Start -.32 of jump)

*All depths are vertical measurements.

"The actual depths in the chute were all less than estimated. The estimate is on the conservative side when considering the height of wall required for the chute. Overestimating the initial depth will result in selecting a basin which will be too long and too shallow. The effect of this error as applied to this case is shown in the following tabulation:

Quantity	Estimated value	Actual value
	feet	feet
Normal depth d_1	1.15	0.87
Initial velocity v_1	20.5	27.1
Froude number F_1	11.1	26.5)
Depth in basin d'_2	4.9	5.4) Calculated
Length of basin L_B	9.1	7.8)

"The importance of estimating the depth and velocity of the jet entering the stilling basin is evident from a study of the preceding table. Overestimating the depth will result in a basin too shallow. Underestimating the depth will result in too short a basin. The best way to estimate this depth, if self aeration is not a factor, would be to compute the flow profile through the chute."

Drainage Studies - T. W. Edminster, Blacksburg, Virginia.-"Mr. Walter L. Turner, Soil Scientist, reports that cores are on hand to be run for the following permeability sites: Five sites were sampled 4 miles south of Chatham on watershed W-II (J. W. Bryant). The number and the soil type for each of these sites are given in the group below

Site No.	Soil Type
VA-201	Mayodan sandy loam
VA-202	"
VA-203	Mayodan fine sandy loam
VA-204	"
VA-205	Cecil clay loam

"Four sites were sampled at the Sandy Level Nursery as indicated in the following list:

Site No.	Soil Type
VA-206	Hiwassee clay loam
VA-207	Hiwassee loam
VA-208	"
VA-209	"

"The sampling on watershed W-II completes the scheme of sampling W-I, II, and III initiated last June. One each of the mimeographed Permeability Determinations for Sites No. VA-167 thru 182 has been given to H. N. Holtan. These cover the sampling done in June.

"Mr. Holtan and M. H. Kirkpatrick are studying the runoff characteristics of the three watersheds.

The following are excerpts from Mr. Walker's Drainage Report:

'Continuation of heavy rainfall in the Holland, Va., area prevented opening of tile laterals on either the Lee or Rawls farm. Results of these observations are necessary to going on with the preparation of the bulletin on tile draining soils that are underlain by "quick sand."

'The City of Suffolk, Va., has encountered failures of septic tank disposal fields when located in soils of the Moyock series. It has found that placing the disposal field laterals on gravel cuts down on the clogging of tile due to sediment from the sandy layer of soil. Also, it has found that the stability of laterals is increased greatly.

'A study has been made of the literature covering examples of this type of solution to the "Quick-sand" problem in soil drainage. So far, examples have been found using gravel under and around tile (gravel envelope) for the purpose of increasing the area for water to collect in before entering tile, but no examples were found of the gravel envelope being used as a sand filter.

'Several letters have been written to drainage specialists on the matter, but, to date, no reply has been received from these men.

'The drainage engineer has questioned for some time the accuracy of the relationship between data secured from 1-inch and 10-inch (diameter) observation wells. Saturated soil lying within the water-table contains a certain percentage of free water while the observation well contains 100 percent water. For the water table to rise within the observation well, water must feed into the well from the soil. Likewise, it must feed back into the soil for the water-table to fall. For a given condition of soil, it seems that this water movement should be the same rate whether it be 1-inch or 10-inch wells. Therefore, for any given fall of the water table within the soil, the 10-inch well must lose 100 times the volume of water that is given up by the 1-inch well. It seemed that the water-movement characteristics of the soil should affect the rate of flow from soil to well (or well to soil) more than the respective areas of wells which is the ratio of 10 to 1. Professor R. K. Frevert, Iowa State College, terms this possible effect as "time lag."

'On the other hand, data from this project presents a different picture. A comparison of data taken from 1-inch and 10-inch wells was made using all 1948-49 data from the Presson farm (Heavy - Lenoir fine sandy loam) and some of the data from the Lee farm (Light - Moyock fine sandy loam). In all, 38 comparisons were made. All but two comparisons were made from data collected from a falling water table. The two comparisons were made at the height of water-table rise.

'Based on this preliminary survey, the following can be noted:

1. By inspection, there is no difference in the accuracy of data obtained from either 1-inch or 10-inch observation wells (as affected by movement of soil water).

2. If there is a "lag" in water-table movement due to change in storage volume from soil to well, it is not evident in equipment used on this project.

3. If there is a "lag" in water-table movement, all equipment must be accurate to the nearest 0.01 foot.

Supplemental Irrigation Studies - J. R. Carreker, Athens, Georgia.- "The daily temperatures throughout September were generally below normal. Rainfall was well distributed during the month, with a total of 3.22 inches. This was but 0.03 inch below the long time average of 3.25 inches. Evaporation from the free water surface pan was 4.63 inches. No irrigations were made.

"The final harvest of the early planted lima beans and tomatoes was made August 26. The average yields of the replicate plots for each treatment on the two crops showed:

	Irrigated	Unirrigated	Decrease with irrigation	
	lb/ac	lb/ac	lb/ac	Percent
Lima beans	7,400	9,220	1,820	19.7
Tomatoes	17,300	20,400	3,200	15.2

"The tomatoes and lima beans were severely damaged with root knot nematodes by the final harvest. The soil was treated with Dowfume N and Dowfume W-40 prior to planting. An examination of the roots when the plants were first beginning to bear indicated only slight damage. Irrigation apparently did not affect this condition, however.

"The lima beans were badly infested with a mildew, Rhizoctonia solani, due to a large extent to the many cloudy humid days in July and August. The irrigations during that period apparently aggravated this condition by making the ground wetter and increasing the humidity of the atmosphere around the plants on those plots.

"The tomatoes were damaged by blight. The irrigations apparently increased this damage."

Drainage Studies - J. C. Stephens, West Plam Beach, Florida.-"Rain in September raised the water table over the Everglades. At the end of the month the arterial canals in the organic soils around Lake Okeechobee were flowing several feet above ground surface and all drainage was by pump. The main outlets from Lake Okeechobee were utilized to full capacity the entire period. At the beginning of the month the lake stage was 14.6 feet., MSL; rose to 14.9 feet at the middle, and was 14.6 at the end. Rainfall during September was 8.95 inches at the Everglades Experiment Station. Evaporation from the open pan was 5.641 inches, while the mean maximum temperature was 89.9 degrees, and the mean minimum temperature was 70.2 degrees.

"Plans were carried forward toward making experiments with chemicals in combating under water mosses in drainage canals. An experimental site was selected and stage-volume curves prepared for the test reach to determine dosage requirements, at different stages. A spray rig to be attached to a boat is under construction at the Experiment Station, and three 55-gallon drums of different napthas type chemicals have been received.

"A weir with contracted end-section with a notch width of 6 feet and 4 feet opening above crest was built for use in connection with the pump testing program at the Experiment Station. The weir was constructed as a thin-plate weir patterned after those described in an article: "Submerged Thin-Plate Weirs" by F. T. Mavis of the Carnegie Institute of Technology, "Engineering News Record," July 7, 1949, pages 65-69. It is planned to use the weir coefficient given in this article in calculating flow.

"With the cooperation of the Dade County Engineer's Office, two new slope courses were established on the Tamiami Canal approximately 20 miles west of Miami. Each slope course is 3,000 feet long and the sites were selected along reaches of different conditions of underwater aquatic moss growth with the view of obtaining more information on the values of 'n' as influenced by such growth in the arterial canals. Flow and fall were measured on both courses and the computations will be made this coming month."

Drainage Studies - M. H. Gallatin, Homestead, Florida.-"Readings made on September 9 showed that for the natural cover and check plots moisture was very low. Readings on the mulched plots, while showing an increase had not reached the point where trees would have suffered.

"While our data show that mulching is beneficial so far as moisture conservation is concerned, I believe it can be shown that the greatest benefits will be derived from increasing the organic matter which will give an increase in storage for plant foods. Samples have been collected bi-monthly and saved and the rate of increase if any will be checked as soon as possible. Physically there is a definite change in the appearance of the various plots so far as soil color. The greatest being in the pine straw and grass mulched areas.

"Our data to date on young lime and avocado groves show that until the organic or duff layer has been increased resistant organic types of nitrogen fertilizer do not give a good response. Until sufficient organic materials have been built up, our data to date indicate that the grower-owner should at least during the summer period apply small amounts (depending upon size of tree) on a monthly basis. The nitrogen portion of the mix should be made up of readily available materials. The reason for the low rate and readily available materials is that our soils have a very low exchange capacity and until this has been increased by building up the organic matter and so changing our soil conditions that we have a storage area and soil organism to utilize the organic types of fertilizing materials.

"Samples collected in the Miami area showed that there has been a definite increase in concentration in chlorides over most of the area. While the increase is not serious at this time with the low rainfall continuing, the concentration will no doubt increase.

"It was suggested to the County Engineers Office (Dade County) that flow of water in all canals out of the area be checked in order to help retain as much head as possible.

"Sampling of the Homestead area shows that there has been a slight increase over the previous months' sampling. Our records show that for the area west of the structure the concentration on the whole was somewhat lower in 1948 and 1947 than it is this year. It was suggested to the County Engineers Office that the flap gages on all structures be closed in order to maintain as high a head of fresh water as possible."

Muck Drainage Studies - R. B. Hickok, Walkerton, Indiana.-"Harvest of crops was completed on the drainage plots and draw-down and feed-back tests started on three plots, with shallow medium and deep drainage. These tests have not been completed and the data compiled. However, a markedly greater rate of lateral movement of water through the muck seems to be indicated on plots that have been deeply drained than on those with shallow drainage. This is indicated also by observations, made in digging pits for soil-moisture samples, that in the plots where the water table has been maintained within approximately 15 inches below the surface, pits dug to 10 inches below the free water (as indicated by the moisture contents of the samples) had little water in the bottom of the holes after they had been open a half-hour or longer; whereas pits similarly below the water table in plots that have been drained 40-45 inches below the surface filled up rapidly to the water-table level. This would indicate that less intensive and possibly less expensive tile systems may be required for satisfactory water-table control if the water tables can be normally held at greater depth than is now common practice. The possibility that an effect of depth of drainage of these muck soils on their permeability may be an important factor in determining their optimum depth of drainage needs further investigation.

Hydrologic Studies - R. B. Hickok, LaFayette, Indiana.-"A field trip was made to the corn plots at Albion on September 23, with several specialist from the University, district conservationists, of the SCS from the northern part of the State and the county agent of Noble County. It was obvious that corn on the experiment plots was comparatively good for the locality. There appeared to be no outstanding differences in prospective yields from the several experimental treatments, except those on which residues had been maintained on the surface of the seed bed. Stands on those plots were reduced. All plots with residues mixed into the surface few inches of soil appeared to have as good yield prospects as the plowed plots. This is in line with 4 years' yield data on the lighter, well-drained soils in the northern part of the State.

"There had been considerable hard rainfall since the last cultivation of the corn and sloping plots which had the meadow residue plowed under showed rilling in the cultivator marks and an inch or more of sand deposited at their lower ends (fines carried on out into meadow border), while there was no evidence of soil or water movement on similar adjacent plots where the residues were mixed into the soil. An earlier inspection, a few days after a rain, had shown moisture at the surface on mixed residue and surface mulched plots with adjacent plowed plots comparatively dry and hard at the surface. The consensus of those who made the field trip in September 23, was that methods of seed-bed preparation for corn which mix good meadow residues into the upper few inches of soil may provide quite effective water control without reduced corn yields, in this section of the State where extremely irregular topography makes extensive contouring operations.

"Mr. E. R. Baugh of the Experiment Station staff, completed some interesting studies on the corn plots at LaFayette during the past summer to determine the amounts and distribution of undecomposed crop residues in the soil late in the corn-growing period. The following table summarizes the results of that work:

Table 1.--Undecomposed organic residues in the soil on mulch tillage experiment plots in corn in late August 1949, Purdue-Throckmorton Farm, LaFayette, Ind.

Treatment No.	Tons/Ac. in upper 10 inches of soil		Tons/Ac. in upper 2 inches of soil	
	4" from stalks	15" from stalks	4" from stalks	15" from stalks
1	6.24	4.31	4.54	2.92
3	4.82	2.85	4.19	1.55
6	5.50	2.80	2.88	1.14
7	3.89	3.60	.69	.79
8	3.49	3.15	.98	.43

No.	Treatments (seed-bed preparation)
1	12" seeding strip, sod removed, tilled 6 - 7"; middles sub-tilled later w/residue left on surface.
3	Sub-tilled to 7" depth, residues left on surface.
6	Residues mixed through 6" depth.
7	Residues turned under 7" deep.
8	First tillage preceding fall, Residues mixed through upper 3", subtilled 7" deep in spring.

"Meadow residues in the mulched plots tended to be moved into the corn rows by the cultivation. Consequently measurements were made at points 4 inches and 15 inches out from the stalks toward the middles, and the average of the two locations is considered to closely represent the total amounts. Treatment No. 8, with initial tillage the preceding fall was started this past year in an effort to improve the timing of the residue decomposition and attendant typing up of soil nutrients by the micro-organisms, relative to the crop requirement for these nutrients, particularly nitrogen. However, this season's study of residues remaining late in the corn season indicates that the total residues remaining and particularly those remaining near the soil surface in the fall tilled plots were very low compared with the mulching treatments started in the spring and close to the level of the plowed plots. This would seem to indicate possibility of substantially reduced water control by mulches with fall tillage. These residues had a relatively high carbon-nitrogen ratio and residues of meadows with more legumes might decompose considerably faster."

DIVISION OF IRRIGATION AND WATER CONSERVATION

Sprinkler Irrigation Studies - W. D. Criddle, Boise, Idaho.-"An important meeting on the Economics of Sprinkler Irrigation was held in Boise and attended by representatives of the Idaho Agricultural Experiment Station, Washington State Experiment Station, Bureau of Agricultural Economics, Bureau of Reclamation and Soil Conservation Service. At this meeting a standard form was suggested for gathering economic information that might be used by all agencies interested in sprinkler irrigation. The Bureau of Agricultural Economics will take the leadership in the preparation of a final form and in contacting the various northwestern State experimental stations to determine what information has already been compiled and what additional information these various stations will be able to gather. The Bureau of Reclamation and the Soil Conservation Service will assist in gathering data in areas not convenient for the State experiment stations."

Friction Losses in Pipes and Fittings - Carl Rohwer, Ft. Collins, Ft. Collins, Colorado.-"The report on Friction Losses in Valves and Fittings for Irrigation Pumping Plants was revised in accordance with the suggestions of Messrs. Scobey and Ewing. It is now being reviewed by the Publications Committee of the Experiment Station. The possibility of publishing this report as a Station technical bulletin was discussed with Dean Evans and Dr. Peterson of the Engineering Division of the Experiment Station.

Rainfall Penetration Studies, San Bernardino County, Calif.- Dean C. Muckel, Pomona, California.-"Analysis was made of the relationship between seasonal rainfall and deep penetration as calculated by deducting transpiration evaporation after rains, and the fall soil-moisture deficiency for 18 different crop or land classifications. The method now being used to determine deep penetration is extremely laborious as it entails the grouping of daily rainfall into storms, then deducting evaporation after storms, transpiration, and amount of rain necessary to replenish the fall deficiency. These calculations are made on a monthly basis for each crop. Data already worked up for Chino Basin, California, by this method were plotted against total seasonal precipitation fo the period 1926-27 to 1945-46, inclusive, and a very good correlation was obtained for all crops, excepting one. It is believed that deep penetration in the future can be estimated rather closely from the curves developed. The curv apply only to Chino Basin and vicinity. Differences in fall deficiencies, transpiration rates and storm occurrences would alter the curves. The plotted data also show the effect of heavy storms resulting in surface runoff and the effect of early fall rains on average fall deficiencies and transpiration rates."

Soil Permeability Studies, Soil Conservation Districts.- V. S. Aronovici, Pomona, California.-"During this month, 80 soil permeability samples were taken in problem areas within the Fallbrook, San Fernando and Antelope Valley Soil Conservation Districts, at the request of Operations. Results secured in a lemon orchard, located within the Fallbrook District, San Diego County, is of particular interest. The orchard, located on a 5 percent slope with a soil of residual origin and having moderate profile development was sampled at 1 to 4 inches and 12 to 15 inches. The latter included the heavier-textured subsoil. Surprisingly, the results showed a topsoil permeability of 1.17 inches per hour, while the subsoil had a rate of 3.4 inches per hour. Irrigation application is accomplished by Rainbird sprinklers at a rate of 0.78 inch per hour. The surface soil has a fair permanent cover crop, yet it appears that the soil surface is the bottle-neck, as some runoff does occur during irrigation. Water

penetration averages less than 20 inches.

Imperial valley Leacing Studies - George B. Bradshaw, Imperial, California. "On the 140-acre test plot which is tiled at a 337-foot grid spacing, the second run of the alternately wetting and drying leaching study has been finished. The soils range from medium to heavy textured and were very saline to a depth of 5 or 6 feet. Before leaching was started, a series of soil samples at various locations in the tract showed a salinity ranging from 30 to 102 tons of salt per acre-foot in the surface foot of soil.

"The following results were obtained during the second 44-day leaching period:

Acre-feet of water applied	394
Tons of salt applied in the leach water	493
Acre-feet of surface waste water	224
Tons of salt removed in the waste water	852
Acre-feet of leach water removed by the tile drainage system	13.9
Tons of salt removed by the tile drainage system	864
Acre-feet of water evaporated from the surface during the second 44-day leaching period	147
Acre-feet of leach water computed to deep seepage	9

"Results from the second run indicate 360 tons of salt, 2.57 tons per acre, were removed from the soil by the surface waste water. Eight hundred and sixty-four (864) tons of salt, 6.17 tons per acre, were removed by the tile drainage system. The combined removal, waste plus tile, was 8.74 tons of salt per acre."

Selected Problems in the Law of Water Rights in the West. (Revision) - Wells A Hutchins, Berkeley, California.-"At the request of the Michigan State Agricultural Experimental Station, the last week of the month was spent at East Lansing, Mich., for the purpose of assisting in the preparation of recommendations for a water law for that State. Preparatory to undertaking this assignment, some time was spent in reviewing decisions of the Michigan Supreme Court on Water-use problems. At East Lansing conferences were held with various members of the staff of the experiment station and others. Assistance was given in preparing a preliminary draft of recommendations for proposed legislation.

Irrigation Studies - Willis C. Barrett, Logan, Utah.-"On applying information received from farmers in the Vernal area regarding the pre-frost growing period and its influence on consumptive water use, a reasonable estimate has been made for alfalfa and pasture. The fall and post-frost period of consumptive use will be observed this year until use practically ceases. A rough cast-up of uses not included in the progress report of last year gives indication that the balance between inflow-outflow quantities and the integration quantities for the Vernal area will not show significant discrepancies.

"As for the Ferron area, water in the 1948 growing season was very short. Inquiries in the field indicate that alfalfa and pasture were exceptionally dry. In many cases but two crops and sometimes only one of alfalfa were cut with

pasture following a similar pattern. For this reason, integration of estimates were high, since they were based on the usual crop returns. It is believed that this year's results will help straighten out these inaccuracies.

"Some thought and investigation has been given to soil sampling equipment, particularly for a sample that will operate below the water table. It is believed that in the following month enough important information will be available to suggest a project with the Experiment Station along this line. This project includes a hand operated mechanical driver to drive soil tubes of large dimensions as well as to greatly facilitate driving the ordinary size soil sampling tubes.

Management of Related Irrigation and Drainage Enterprises - J. Howard Maughan, Logan, Utah.-"Farmers of the Cub River Irrigation Company area require an unusually small irrigation supply. In the Lewiston-Fairview Section, a tract of 17,000 irrigated acres, the total annual water supply available is only 28 inches, of which 16 inches is from precipitation and 12 inches irrigation water. Yet this area produces average crop yields of 68 bushels of barley per acre and other crops in proportion. The area is isolated from outside water supplies, either above or below ground, except as provided by precipitation or irrigation supply.

"The reasons for such economical water use are found principally in the soil relationships. This area is underlain with a deep and impervious clay sub-soil through which little water excapes in natural drainage. The clay stratum is flat to very gently sloping so there is little loss of water from the area along its surface. Soils above the clay are highly permeable sand and sandy loams varying in depth from a few feet up to 20 feet. The irrigation water and precipitation enter these loose soils readily. The area sub-irrigates and usually the surface of the ground appears dry. The result is that while there is a high water table from 2 to 4 feet, or less, below the ground surface the gross water supply for this area is not much more than the consumptive use of crops grown within the area.

Irrigation Studies - Fred B. Hamilton, Lincoln, Nebraska.-"Some of the data gathered in the study of row irrigation last summer has been analyzed. A chart is attached which shows the manner in which part of the data will be presented. (This chart was attached to Hamilton's report and is not submitted here.)

"The slope infiltration graph shows the distribution of water by 300-foot zones on a 900-foot run of Hastings silt loam. The chart illustrates the following facts:

1. Minor topographic irregularities influence distribution more than length of run of this particular field.

2. The application was too light on this type of soil.

3. Runoff was excessive.

"An interesting corollary observation is the fact that in rows labeled sub 1 the runoff was consistently higher than in rows marked sub 2. The sub 1 rows in each case were those in which the rear wheel of the tractor traveled.

One of the runoff and infiltration charts is being annotated and sent to Dr. Nichols with this report."

11/3/49